REPORT DOCUMENTATION PAGE

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
06-09-2008	Final Report	From 04-01-2007 To 03-31-2008

4. TITLE AND SUBTITLE
Reaction mechanisms and Velocity in Dense, Layered, nanoenergetic materials

5a. CONTRACT NUMBER
FA9550-07-1-0349

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Coffey, Kevin R.

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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10. SPONSOR/MONITOR'S ACRONYM(S)
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AFRL-OSR-VA-TR-2013-0953

12. DISTRIBUTION/AVAILABILITY STATEMENT

13. SUPPLEMENTARY NOTES

14. ABSTRACT

This project served to extend the development of nanoscale thermite-based energetic materials and consisted of the four following tasks which have been completed.

1) Develop an optical time-of-flight reaction velocity measurement technique suitable for use with free-standing nanolayered thin films.
2) Continue examination of the Al/CuO materials system to assess an empirical upper limit for the reaction velocity as a function of thin film processing and layer structure.
3) Provide samples to collaborators, for further characterization of the reaction process and mechanisms.
4) Continue the development of sample handling procedures for these materials.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(Include area code)*

Grant/Contract Title: Reaction mechanisms and Velocity in Dense, Layered, nanoenergetic materials
Grant/Contract Number: FA9550-07-1-0349

This project consisted of the four following tasks which have been completed.

1) *Develop an optical time-of-flight reaction velocity measurement technique suitable for use with free-standing nanolayered thin films.* This task has been completed, and measurement data are shown in figure 1. This sample exhibits an average propagation velocity of 161 m/sec, confirming previous high speed photography measurements of freestanding films of 150 ± 30 m/sec wherein the accuracy was limited by the photographic frame rate.

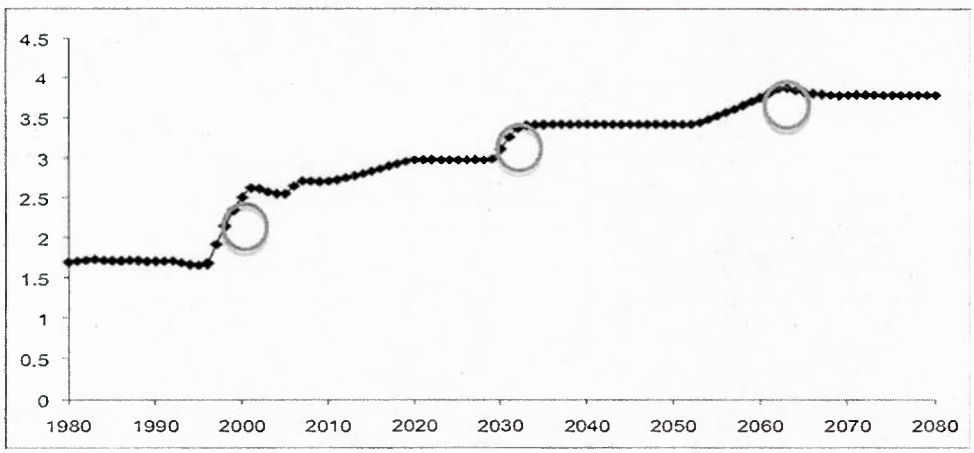

Figure 1: Reaction of a free-standing film sample with the [Al 26nm/CuO 54nm]$_{40}$ structure
Peak 1-to-2 is 156.25 m/s and peak 2-to-3 is 166.67 m/s

2) *Continue examination of the Al/CuO materials system to assess an empirical upper limit for the reaction velocity as a function of thin film processing and layer structure.* Both poster and powerpoint presentations of the results of our continued examination of these materials were presented during at the AFOSR Nanoinitiative Meeting, May 5-7, 2008 in Fairborn, Ohio. These presentations are attached.

3) *Provide samples to collaborators, for further characterization of the reaction process and mechanisms.* These samples were prepared for shipment and the MSDS documentation to enable receipt was also generated and provided. Evaluation of these materials is pending the collaborator's permission to ship, which has been delayed as their experiment has been delayed.

4) *Continue the development of sample handling procedures for these materials.*
For the highest performance samples with the [Al 26nm/CuO 54nm]$_{40}$ structure, the initial yield was slightly less than 30% with the losses (due to electrostatic discharge events) evenly distributed between losses during deposition and post deposition handling. Post deposition losses were brought to a minimum through keeping the material at ground potential. Deposition losses were reduced by increasing the conductivity of the sample holder by pre-coating with copper and the mechanical grounding of the systems transfer mechanisms. These changes improved the yield for these structures to 75%, which will enable further development of samples having a higher reaction velocity.

Final Progress Survey Profile Report

Date Published: 09/08/2008

Page One

1. Principal InvestigatorName:

Kevin R. Coffey

2. Grant/Contract Title:

Reaction mechanisms and Velocity in Dense, Layered, nanoenergetic materials

3. Grant/Contract Number:

FA9550-07-1-0349

4. Reporting Period Start (MM/DD/YYYY):

04/01/2007

5. End (MM/DD/YYYY):

03/31/2008

6. Program Manager:

Michael Berman

7. Annual Accomplishments (200 words maximum):

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8. Archival Publications (published) during reporting period:

None

9. Changes in research objectives (if any):

None

10. Change in AFOSR program manager, if any:

None

11. Extensions granted or milestones slipped, if any:

No-cost extension was granted to extend the project end date from 11/31/207 to 03/31/2008

12. Attach Final Report (max. 2MB)(If the report is larger than 2MB, please email file to program manager.)

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13. Please attach saved SF298 Form here: (Please be sure to have already saved the SF298 Form, that you plan to attach to this survey, to your desktopso that it may be uploaded within this field.)

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